



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
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**Decision Rationale
For the Total Maximum Daily Load for
The Aquatic Life Use Impairment on
South Run Fauquier County, Virginia**

Signed

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Decision Rationale

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I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by a state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water-quality limited water body.

This document will set forth the U. S. Environmental Protection Agency's (EPA) rationale for approving the TMDL for the aquatic life use impairment on South Run. EPA's rationale is based on the determination that the TMDL meets the following eight regulatory conditions pursuant to 40 CFR §130.

- 1) The TMDL is designed to implement applicable water quality standards.
- 2) The TMDL includes a total allowable load as well as individual waste load allocations (WLAs) and load allocations (LAs).
- 3) The TMDL considers the impacts of background pollutant contributions.
- 4) The TMDL considers critical environmental conditions.
- 5) The TMDL considers seasonal environmental variations.
- 6) The TMDL includes a margin of safety (MOS).
- 7) There is reasonable assurance that the TMDL can be met.
- 8) The TMDL has been subject to public participation.

II. Background

The South Run Watershed is located in Fauquier County, Virginia. South Run is a tributary to Broad Run Basin. The benthic impairment on South Run extends 2.34 miles beginning just downstream of Lake Brittle and ending at its mouth on Lake Manassas. The 4,500-acre watershed is fairly well developed with forested, agricultural, and developed lands each making up approximately a third of the watershed.

In response to Section 303(d) of the CWA, the Virginia Department of Environmental Quality (VADEQ) listed South Run (VAN-A19R-04) on Virginia's 1998 Section 303(d) list as being unable to attain the general standard due to an aquatic life use impairment identified through benthic assessments. Virginia's 2004 Section 303(d) list identified a primary contact

use (bacteriological) impairment on South Run. A separate TMDL will be developed to address the primary contact use impairment.

To assess the biological integrity of a stream, Virginia uses EPA's Rapid Bioassessment Protocol II (RBPII) to determine status of a stream's benthic macroinvertebrate community.¹ This approach evaluates the benthic macroinvertebrate community between a monitoring site and its reference station. Measurements of the benthic community, called metrics, are used to identify differences between monitored and reference stations.² The state is currently in the process of changing this methodology to a stream condition index (SCI) approach.

As part of the RBPII approach, reference stations are established on streams which are minimally impacted by humans and have a healthy benthic community. These reference stations represent the desired community for the monitored sites. Monitored sites are evaluated as non-impaired, slightly impaired, moderately impaired, or severely impaired based on a comparison of the biological community of the reference and monitored sites. Streams that are classified as moderately (after a confirmatory assessment) or severely impaired after an RBPII evaluation are classified as impaired and are placed on the Section 303(d) list of impaired waters.

A total of sixteen benthic assessments were conducted on South Run from 1994 through 2005. Thirteen of these analysis occurred bi-annually between 1994 and 2000. Eleven of the sixteen assessments found the benthic community to be moderately impaired. The community was found to be slightly impaired in the five other assessments which occurred in 1999, 2000 and 2004. From 1994 through 2000 an assessment station on Catoctin Creek was used as the reference station for the RBPII assessments. The reference station for the 2004 assessments was located on Goose Creek. Using the SCI to evaluate the sixteen benthic assessments on South Run yielded similar results.

The RBPII analysis assesses the health of the macroinvertebrate community of a stream and will inform the biologist if the stream's benthic community is impaired. However, it will not inform the biologist as to what is necessarily causing the degradation of the benthic community. Additional analysis may be required to determine the pollutants which are causing the impairment as information can be gleaned based on the composition of the community and the condition of the habitat. TMDL development requires the identification of impairment causes and the establishment of numeric endpoints that will allow for the attainment of designated uses and water quality criteria.³

¹Tetra Tech 2002. Total Maximum Daily Load (TMDL) Development for Blacks Run and Cooks Creek. Fairfax, Virginia.

²Ibid 1

³Ibid 1

A stressor analysis was conducted to determine what pollutant or pollutants were impacting the benthic community on South Run. Several possible stressors were evaluated against Virginia's applicable numeric water quality criteria or guidance thresholds. Based on the water quality data, temperature, pH, organics and metals were ruled out as stressors. Although pH was found to periodically violate the state criterion, it happened infrequently and the violations were minimal. Organics and temperature were ruled out as possible stressors since they were not detected above any established threshold or criterion. Although, dissolved oxygen (DO) concentrations were not found to be violating the applicable state criterion, the stressor analysis concluded eutrophication was occurring. There were several pieces of evidence that pointed to a eutrophication problem including the large observed swings (4 mg/l) of DO exhibited during the diurnal DO sampling, the elevated phosphorous concentrations observed in South Run and the excessive algal growth noted by state biologists. If the 4 mg/l DO swing observed during the diurnal DO sampling event is applied to other DO measurements taken from South Run, violations of the DO criteria are observed. The phosphorous measurements taken from South Run were routinely above the 75th percentile of DEQ's reference values for ecoregion 9.

Eutrophication is a process by which excessive nutrient loads enter the system and cause an increase in primary production. Phosphorous, an essential nutrient, impacts the DO concentration by providing a fuel for increased primary production. When primary production occurs at unsustainable levels, the DO concentrations experience a daily cycle of highs and lows. During daylight hours, primary producers release oxygen as part of photosynthesis. In the evening and early morning hours, these same organisms consume oxygen through respiration. In a nutrient enriched system, the DO concentrations can be extremely high during daylight hours (above even the saturation rate) and come crashing down during nighttime hours when primary producers consume DO. Both the low DO levels in evening hours and the swing in DO concentrations are detrimental to the aquatic community.

A reference watershed approach was used to estimate the necessary load reduction needed to restore a healthy aquatic community and allow South Run to achieve its designated uses. Popes Head Creek was used as the loading reference watershed to South Run. The majority of the phosphorous concentrations on Popes Head Creek were below the median and mean reference values for ecoregion 9 and the diurnal DO swing was 1 mg/l. Based on the phosphorous concentrations and DO swing, a eutrophication problem was not exhibited on Popes Head Creek and it was determined to be an appropriate reference watershed. Table 1 identifies the TMDL loadings to South Run.

Table 1 - Summarizes the Specific Elements of the TMDL.

Segment	Parameter	TMDL	WLA	LA	MOS
South Run	phosphorous (t/yr)	0.562	0.038	0.496	0.028
	Phosphorous (t/day)	0.0015	0.0001	0.00135	0.00007

The benthic TMDL was developed using the Generalized Watershed Loading Function (GWLF) model. The GWLF model was used to model the phosphorus loading to South Run. The GWLF model provides the ability to simulate runoff, sediment, and nutrient loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land).⁴ GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.⁵ Calculations are made for phosphorus based on daily water balance totals that are summed to give monthly values.

The United States Fish and Wildlife Service has been provided with copy of the TMDL.

III. Discussion of Regulatory Conditions

EPA finds that Virginia has provided sufficient information to meet all of the eight basic requirements for establishing an aquatic life (benthic) use impairment TMDL for South Run. EPA is therefore approving the TMDL. EPA's approval is outlined according to the regulatory requirements listed below.

1) The TMDL is designed to meet the applicable water quality standards.

As stated above, the biological assessments on South Run documented that a benthic impairment existed on the stream. The benthic assessments did not discern a stressor to South Run. Therefore, a stressor identification study was conducted. As stated above, an excessive phosphorous load was determined to be impacting the benthic community in South Run. The goal of this TMDL was to restore benthic community on South Run.

An appropriate phosphorous endpoint was needed for South Run. Since the state does not currently have nutrient criteria, DEQ looked to an unimpaired watershed with a minimal phosphorous load to obtain the TMDL endpoint. Popes Head Creek was used as the reference watershed to obtain the TMDL endpoint. A GWLF model was developed for both watersheds to determine their average annual phosphorous loads based on model runs from 1994 through 2004. Daily temperature and precipitation data which drive the model were obtained from the Upper Occoquan Sewage Authority. The hydrology for Popes Head Creek was calibrated to a local gage near the mouth of the watershed. It is believed that if the phosphorous loads on Popes Head Creek can be obtained on South Run, the benthic community can be restored.

⁴Ibid 1

⁵Ibid 1

- 2) *The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.*

Total Allowable Loads

Virginia indicates that the total allowable loading is the sum of the loads allocated to land based precipitation driven nonpoint source areas (forest and agricultural land segments) and point sources. Activities that increase the levels of phosphorous to the land surface or their availability to runoff are considered flux sources. The actual value for total loading can be found in Table 1 of this document. The total allowable load is calculated on an annual basis.

Waste Load Allocations

There are several point sources in the South Run Watershed one is a single family treatment unit, two are construction sites and one is the Vint Hill Waste Water Treatment Plant. The Vint Hill WWTP currently discharges its effluent to South Run. However, the facility is expanding and intends to move its discharge to a nearby watershed that can accommodate the loading. Currently, the facility discharges 0.175 tons of phosphorous per year to South Run or roughly 25 percent of the current loading. It is believed that the removal of this source of phosphorous from the watershed will allow South Run to support a non-impaired benthic community. A WLA has been provided for the single family unit and an additional loading has been provided for future growth. Table 2 documents the WLAs for South Run.

EPA regulations require that an approvable TMDL include individual WLAs for each point source. According to 40 CFR 122.44(d)(1)(vii)(B), "Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA pursuant to 40 CFR 130.7." Furthermore, EPA has authority to object to the issuance of any National Pollutant Discharge Elimination System (NPDES) permit that is inconsistent with the WLAs established for that point source.

Table #2 – WLA for Phosphorous for South Run

Facility Name	Permit Number	WLA (Tons/yr)
Single Family Residence	VAG406134	0.026

Load Allocations

According to Federal regulations at 40 CFR 130.2(g), LAs are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading. Wherever possible, natural and nonpoint source loads should be distinguished. The GWLF model was used to

ascertain the phosphorous loading to South Run. The model provides the phosphorous load to the stream through the use of the universal soil loss equation (USLE). The USLE derives the phosphorous loading by using information on precipitation rates, best management practices, land slope, and vegetative cover. Table 3 identifies the current and TMDL loading for phosphorous to South Run.

Table 3 - LA for Phosphorous for South Run

Source Category	Existing Load (tons/yr)	Proposed Load (tons/yr)	Percent Reduction
Forest	0	0	0
Agriculture	0.253	0.253	0
Developed	0.143	0.143	0
Failing Septic Systems	0.011	0.011	0
Groundwater	0.088	0.088	0

3) The TMDL considers the impacts of background pollution.

The TMDL considers the impact of background pollutants by considering the phosphorous loadings from background sources such as forested land.

4) The TMDL considers critical environmental conditions.

According to EPA's regulation 40 CFR 130.7 (c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of South Run is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards⁶. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

⁶EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

The model was run over a multi-year period to insure that it accounted for a wide range of climatic conditions. The allocations developed in this TMDL will therefore insure that the criterion is attained over a wide range of environmental conditions including wet and dry weather conditions.

5) The TMDL considers seasonal environmental variations.

Seasonal variations involve changes in stream flow and loadings as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flows normally occur in early spring from snow melt and spring rain, while seasonally low flows typically occur during the warmer summer and early fall drought periods. Consistent with the discussion regarding critical conditions, the model and TMDL analysis effectively considered seasonal environmental variations through the use of observed weather data over an extended period of time and by modifying waste application rates, crop cycles, and livestock practices.

6) The TMDL includes a margin of safety.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. The MOS may be implicit, built into the modeling process by using conservative modeling assumptions, or explicit, taken as a percentage of the WLA, LA, or TMDL. An explicit MOS was used for the TMDL by reserving 5 percent of the TMDL loading to the MOS.

7) There is a reasonable assurance that the TMDL can be met.

EPA requires that there be a reasonable assurance that the TMDL can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs such as Section 319 of the CWA, commonly referred to as the Nonpoint Source Program.

8) The TMDL has been subject to public participation.

During the development of the TMDL for South Run, public meetings were held to discuss and disseminate the TMDL. A basic description of the TMDL process and the agencies

involved was presented at the first public meeting on March 30, 2005 at the Sully District Government Center in Chantilly, Virginia. The second public meeting was held on December 14, 2005 at the Sully District Government Center in Chantilly, Virginia. The third and final public meeting was held on March 15, 2006 at the Central Community Library in Manassas, Virginia. Notices for the public meetings were placed in the Virginia Register. All three meetings were open to a 30-day public comment period.